



## **The influence of hydrothermal brine on the short-term strength and elastic modulus of sandstones from exploration well EPS-1 at Soultz-sous-Forêts (France)**

Alexandra Kushnir, Michael Heap, Thierry Reuschlé, and Patrick Baud  
EOST, University of Strasbourg, Strasbourg, France

Laboratory studies designed to provide the strength of rocks are typically performed on either dry or water-saturated rock samples. To better understand the mechanical behaviour of rocks in a geothermal context, we provide here the short-term strength and static elastic modulus of sandstones from exploration well EPS-1 at the Soultz-sous-Forêts geothermal site (France) saturated in hydrothermal brine sourced from the adjacent production well GPK-2. We performed 59 uniaxial experiments on samples of Buntsandstein sandstones sampled from six depths (1008, 1022, 1069, 1107, 1290, and 1414 m). Samples were deformed oven-dry (i.e. unsaturated), water-saturated (deionised water), or brine-saturated. Relative to the dry state, strength was reduced by between 24 and 39% and elastic modulus was reduced by between 9 and 19% when the samples saturated with water. However, we observed no measurable difference in strength and elastic modulus between samples saturated in water and brine. These reductions in strength and elastic modulus in the presence of water or brine are considered the result of a reduction in specific surface free energy. Changes to short-term strength and elastic modulus in the presence of hydrothermal brines likely require brines with higher salinities and/or lower values of pH than those typically found within the Upper Rhine Graben (the brine from GPK-2 has a salinity of  $\sim 10\%$  and a pH of 5.5). These new data can be used to assist reservoir prospection, stimulation, and optimisation strategies at the geothermal sites within the Upper Rhine Graben.